OVERVIEW PAPER: B

AN OVERVIEW OF AERS RESOURCE ECONOMICS RESEARCH

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Introduction

The current field of specialization called resource economics within the Department of Agricultural Economics and Rural Sociology (AERS) at The Ohio State University has historical roots in both land economics and community development. In recent years, it has been operationalized in both research and extension at Ohio State as the economics of rural communities and natural resource utilization. The primary focus has been on the State of Ohio. However, increasing evidence of complimentarity exists with both developed (e.g., land use controls and waste management in England, and crop residue for energy in France) and developing (e.g., rural water supply in Africa and Asia, gasohol in Brazil and soil loss and forest biomass for energy in Ghana and the Dominican Republic) countries.[1]

This paper attempts to briefly sketch some historical/conceptual roots and international comparisons for both the rural community and natural resource subsets of this field of specialization. Detailed data on Ohio population, employment, natural resources, etc. are presented to provide a basis for understanding the current department domestic research program in this field (see Appendix A and B). Finally, some future focuses or emerging issues are identified from contemporary authors, the current situation in Ohio, surveys of client users and AERS faculty

that appear to have relevance for establishing community and natural resource economics research priorities for the next 4 to 5 years.

Historical/Conceptual Roots[2]

Natural Resource Economics

For at least a century after the American Revolution the basic U.S. land policy premises were that private action would: a) provide an adequate supply of raw materials and b) result in nearly universal family farm ownership. The 1880's saw the emergence of a group of German influenced economists concerned with reform of U.S. land policies. The group included names such as Ely, Patton and James and they were generally rooted in political economy and law. It was this same group which joined together to found the American Economics Association.

In 1892, John Ely left John Hopkins University and joined the faculty at the University of Wisconsin; a move many consider to be the beginning of land economics as a field of specialization. Until World War I land economists were primarily concerned with the predominant owner/operatorship patterns of farm land. From World War I until 1930 interest turned to tax delinquency and land utilization including soil erosion problems. Both the Soil Conservation Service and the Division of Land Economics evolved in the United States Department of Agriculture during this era.

The Great Depression of the early 1930's fostered a "back to the land" movement in the urban fringe areas. This in turn stimualted interest in land use planning and several rural assistance or development programs. The Farm Security Administration, Rural Electrification

Administration, Indian Service and some initiatives of the Cooperative Extension Service and farmer cooperatives are examples of major program thrusts. The all-consuming war effort and recovery of the economy in the 1940's resulted in declines in most of these rural assistance programs.

Concerns in the post-WW II to early 1960's era concentrated on the legal, historic and property rights aspects of resource tenure. Emery Castle called on land (or natural resource) economists to recognize and deal more explicitly with externalities in production and consumption and with indivisibilities.[3] According to Castle, "we have become too immersed in the internal workings of the theory of the firm without concern for how the firm relates to its environment." He urged identification of principles for treatment of externalities and indivisibilities which in turn would help identify appropriate market and nonmarket correctives. Increased evidence of agricultural surpluses in the 1960's also resulted in increased emphasis on supply control and conservation programs such as the Land Bank of the Agricultural Stabilization and Conservation Service.

Kelso sounded a similar theme to Castle in his AAEA Fellows Address in 1976. He pointed out that individualized ownerships of natural resource parcels results in externalities and public good elements, nonreproducibility of stock resources consumed in production and the presence of rents which are not eliminated and may even be accentuated by competition. Thus, maximization of the state of well being of the society often requires a "monopoly solution" of the natural resource problems (20).

The National Natural Resources Inventory completed in 1977 found that 34 percent of the nonfederal cropland in the U.S. experienced sheet, rill and wind erosion at rates exceeding the tolerance levels of four tons per acre per year (35). The resulting increase in water treatment costs, harbor dredging costs, reduced fish catch, etc., plus the uncertain impact on agriculture productivity are troubling. Professor Don Paarlberg concludes that "concerns with the environment in the U.S. are very deep and widespread. Farmers and the agricultural establishment have underestimated this concern and their 'knee jerk' reactions have been both inappropriate and ineffective."

A recent U.S./A.I.D. two volume report to the U.S. Congress concluded that "the critical environmental resources of developing countries are today subject to stresses of unprecedented magnitude. The health, nutrition and general well-being of the poor majority are directly dependent on the integrity and productivity of these resources. Thus, the capability of governments to manage them effectively over the long term may be the most important prerequisite to the eradication of poverty the fulfillment of basic human needs and the ultimate achievement of sustained development (7)." Ward and Eckholm in analyses done for the U.N. Environment Programme came to similar conclusions on the state of the natural environment in the devloping world (37).[4] This evidence suggests the potential for more involvement of natural resource economists from the developed world. This is particularly true in those developing countries considering various biomass for energy options which may put additional stress on the environment (18).

Economic analysis has been done on a wide range of agriculture and natural resource projects in developing countries in recent years in what Price Gittinger calls the "cutting edge of development." Agricultural/ resource economists have done much of this analysis in conjunction with

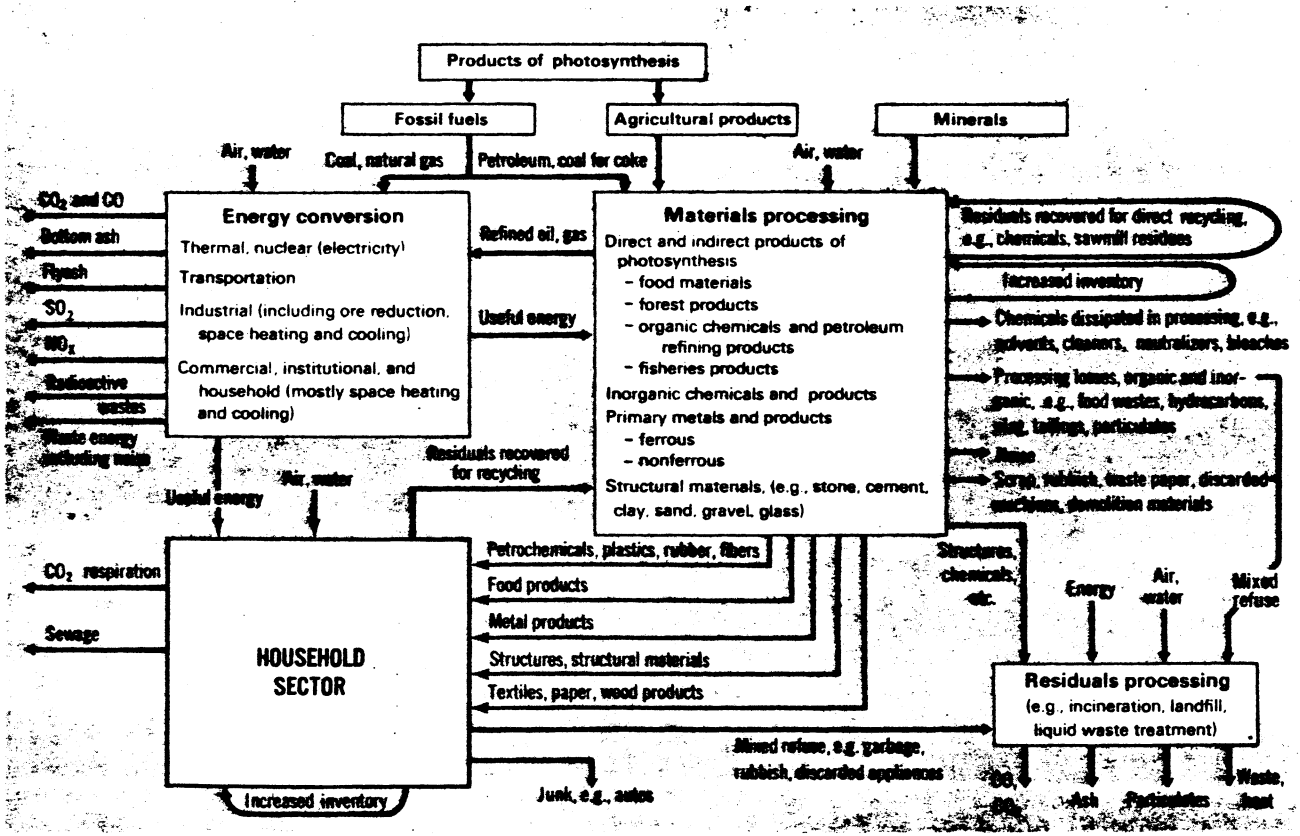
international lending agencies such as the World Bank. With the exception of foreign exchange shadow pricing issues and financial vs. economic distinctions, many similarities exist between this work in developing countries and the substantial cost-benefit literature on natural resource projects in the United States. The latter work has tended to place relatively more emphasis on amenity and non-market values and technological externalities both in terms of shadow pricing and the development of environmental impact statements. Unfortunately, very little interaction has occurred between the agricultural/resource economists working in these respective areas.

Much of the controversy over the environment stems from the tendency to treat it as a free good or God given right rather than a source of raw materials and a waste disposal "sink" with limits. In the simplest materials balance model (Figure 1), the environment can be viewed as a large shell surrounding the economic system. It has the same relationship to the economy as does a mother to an unborn child--it provides sustenance and carries away wastes. Raw materials flow from the environment, are processed in the production sector (that is, converted into consumer goods), and then--at least in part--pass on to the household sector. The materials returning to the environment from the household sector are wastes or residuals. They are the unwanted by-products of the consumption activities of households. Similarly, not all of the material inputs that enter the production sector are embodied in the consumption goods flowing on to the household sector. These are the wastes or residuals from production. Thus, there is a flow of residuals from both the production and consumption sectors back to the environment (9).

These material flows must obey the basic law of physics governing the conversion of matter. In an economy with no imports or exports, and where there is no net accumulation of stocks (plant, equipment, inventories, consumer

Figure 1

Schematic depiction of materials balance model. *Source.* Reprinted by permission from Allen V. Kneese, Robert U Ayres, and Ralph C. d'Arge, *Economics and the Environment: A Materials Balance Approach,* Washington: Resources for the Future, Inc., 1970.



durables, or residential buildings), the mass of residuals returned to the natural environment must be equal to the mass of basic fuels, food, materials, and other raw materials entering the processing and production system, plus gases taken from the atmosphere. Of course, this neglects the conversion of miniuscule amounts of matter into energy by nuclear reactors producing electricity. This is the principle of materials balance. This principle must hold true for each sector of the economic system taken separately, and for the economic system as a whole. Thus, in the absence of inventory accumulation, the flow of consumer goods from the production sector to the household sector must be matched by an equal mass flow back to the environment (9).

The above figure shows flows of energy in addition to material flows. Energy balances could be drawn up to account for the division of energy production among useful work, noise, and waste heat being dissipated into the air and water. The law of conservation of energy dictates that all energy inputs into the economic system--as well as materials inputs--must eventually find their way back to the environment in some form such as waste heat. In fact, some have suggested that the ultimate limit on economic growth may come not from the scarcity of resources, or overpopulation, but the environment's limited capacity to absorb heat residuals from the economy (9).

The concept of material balance is particularly relevant as the agricultural and forest industries move into an era of rapid increases in fossil fuel prices. Energy related input prices are increasing for agriculture as well as other industries. However, higher fossil fuel prices and some tax breaks are also making the production of energy from certain grown organic feedstocks (e.g., ethanol from sugar cane in

Brazil and corn in the Midwest U.S., wood waste combustion, etc.) look financially attractive. A major biomass for energy initiative could result in soil loss, etc. from conversion of marginal lands and removal of crop and forest residues for energy. However, biomass based fuels are potentially renewable/sustainable and unlike fossil fuels do not add net amounts of CO_2 to the atmosphere (18).

Most developed countries particularly in Europe and Scandanavia have a much longer history of rural resource development policies and programs, particularly regarding land use controls. Yet, very little comparative or collaborative work has been done between resource economists in the United States and other developed countries. A recent encouraging development is a Kellog funded conference to be held in Kristianstad, Sweden in June 1981. The conferance will bring together forty resource economists from Northwestern Europe and North America to focus on major lessons learned in developing land use, rural development and environmental policies.

Rural Community Economics

Henricks has traced the origins of community and/or rural development as a concept or basic approach for dealing with the problem of improving living conditions in a community. He suggests that this concept was introduced within the framework of economic and technological aid generally given to rural areas of the low-income countries of Asia after WW II (13). Sherrard finds evidence of the underlying philosophy, practices and methods of community development in certain indigenous movements such as those of Mahatna Ghandi, missionary sponsored rural improvement projects and projects promoted by enlightened local leaders, colonial leaders or international social welfare workers (32).

Although the funding was extremely limited, a number of U.S. economic and/or area development initiatives of the 1950's recognized that (1) agriculture was not the sole source of rural economic development, (2) that many more non-farmers than farmers lived in rural areas, and (3) that off-farm employment could become an important source of income, particularly for small farmers. The rural dimension of the "War on Poverty" during the 1960's is best documented by the findings of the President's National Advisory Commission on Rural Poverty titled The People Left Behind. Based on these findings, Bishop (1967) challenged his fellow agricultural economists in his 1967 A.A.E.A. Presidential Address with the following (3):

> "Our concentration on the farm as a producing unit contributed to our neglect of the problems of rural families as consuming units. Our contribution to an understanding of the problems involved in providing education, health and related services in rural areas has suffered accordingly. As economists, we cannot content ourselves only with information transmitted through markets. As an institution, the market transmits only certain kinds of information. The interests of economists extend far beyond market phenomena. As the urban process penetrates deeper into rural America, we must show more concern about the effectiveness with which social, political and economic institutions meet the needs of people in rural areas."

Increased interest in rural development led to efforts by agricultural economists to define and delineate the concept more precisely. A North Central Regional task force defined it as "improving the level and distribution of opportunities among rural residents and improving the processes for achieving adequate: (1) employment, income and wealth, (2) preparation for and participation in collective decision making, (3) services and facilities and (4) physical and cultural environments." Acceleration in congressional as well as academic concern[6] in the early 1970's culminated in the Rural Development Act

of 1972 (RDA-72). The major titles of the act included (34):

Title I Amendments of the FHA Act of 1961

Title II Amendments to the Watershed Protection and Flood Prevention Act

Title III Amendments to the Bankhead-Jones Farm Tenant Act

Title IV Rural Community Fire Protection

Title V Rural Development and Small Farm Research and Education

Title VI Miscellaneous Administrative Realignments

Most of the involvement in RDA-72 of agricultural and/or resource economists has centered on Title V. This title provided for rural development and small farmer research extension and development programs through the colleges and universities in each state. The state Land Grant institution under the Morrill Act of 1862 has been the designated administrator of the respective state programs.

A significant population reversal first documented by Calvin Beale in the mid-1970's continues and has generated considerable interest and many unanswered questions. In the 1970-73 period Beale found that non-metro counties in the U.S. had an average population growth of 4.2 percent compared to 2.9 percent for metro counties. Similar trends have been documented in several European and Scandanavian countries (2). This trend raises important issues on the environment, and public service preference assessment, financing and delivery resulting from the population movement in both the donor and recipient communities.

Increased employment opportunities in rural areas from decentralization of manufacturing (which has been going on since tne WW II era) is one of the factors influencing the population migration of the early 1970's. Hanson suggests that low skill labor intensive industries have

historically been attracted to rural areas due to lower labor costs, relatively cheap land and easy access to work and recreation areas. Estimating the public and private sector benefits and costs of various rural industrialization or employment generation scenarios has been an increasing concern of agricultural economists since the mid-1970's.

The Rural Development Policy Act of 1980 (P.L. 96-355) provides for the coordination of a national rural development policy and the establishment of a USDA Under Secretary for Rural Development. The act amends and strengthens the Rural Development Act of 1972 by placing more rural development leadership in the Executive Branch, calling for a systematic review and assessment of Federal rural development program coordination with state and local governments and upgrading budget projections and reporting requirements. It also extends Title V of RDA-72 through FY 1981, strengthens involvement of 1890 universities, extends the benefits to four additional U.S. territories, increases technical assistance authority of FmHA to $15 million, and expands the funding eligibility of state institutions to disseminate information and technical assistance on federally sponsored or funded programs.

A recent World Bank report estimates that over one billion people in rural areas of the world do not have an adequate water supply for domestic use. In addition, the rate at which access to safer water is being provided is not adequate to keep pace with population growth in rural areas (36). Since waterborne or water-related diseases are among the three major causes of sickness and death, the Bank is increasing funding in rural water supply and sanitation projects.

Rural roads and bridges are of increasing concern in both developed and developing countries. The deteriorating conditions of rural roads

and bridges in the United States and the increasing gap between replacement needs and available revenues is of increased concern (17). The situation in developing countries is frequently the absence of rural roads and bridges rather than replacement of existing structures.

Alvin Toffler sketches out some future forces or issues that may be relevant to rural community economics research in what he describes as the "Third Wave". Toffler's third or future wave follows the earlier agricultural and industrial revolution (or first and second waves) but has some distinctive features. Businesses will be more human oriented and conformity will be less desirable and necessary. Toffler coined a term "demassification" of production and consumption to describe this phenomenon. Computers and robotics will have an increased role in production and consumption. There will be a shift in jobs from the factory to the home in what Toffler describes as an already emerging "electronic cottage industry". Regionalism will increase in importance fostering a New Federalism (29).

The CED report on Key Economic Issues in the 1980's identifies a number of U.S. demographic and labor force changes including: (1) a higher percent of prime age population, (2) a decline in the relative importance of teenagers and young adults, (3) increased participation of women in the work force, (4) a better educated work force and (5) spot shortages of skilled workers, particularly in engineering and computers. The worker/non-worker dependency ratio is expected to decline in the 1980's but rise again in the next century. The CED report touches on many of the same issues as Toffler in describing the changing character of work and sees increased questioning of economic decisions in both the private and public sectors. A growing

awareness of international economic interdependence and the increased importance of third world countries are also cited as key economic issues in the 1980's (31).

In a recent AAEA Newsletter, Luther Tweeten, current AAEA President, laments the decline in U.S. rural development policy. Tweeten cites the following underlying forces as being prime contributors to this decline: (1) the demographic transition (2) the world food shortage of the early 1970's, (3) the rise of the alternate agriculture-small-farm movement and (4) stagnant real funding for agricultural sources in general. Tweeten argues that rural poverty and underemployment continue to be serious problems requiring additional support for research and extension on rural development policy in Land Grant universities.

Ohio in Perspective

Rural Population and Employment

Ohio ranked fourth behind Pennsylvania, North Carolina and New York with 2,628,673 rural residents in 1970. Farm residents comprised 14 percent of the total rural population in Ohio. On the other hand, people living in small towns of 75 to 2,500 population constituted 35 percent of Ohio's rural population and approximately 10 percent of its total population in 1970. Small towns differ greatly in their population growth and decline. Ninety-five percent of the incorporated towns of 75 to 2,500 inhabitants grew in population between 1930 and 1970--the epoch of agricultural mechanization and rural to urban migration. The unincorporated towns, however, present quite a different

picture. Sixty-four percent of these towns lost population during the same period. The latter group constitutes 5 percent of Ohio's population (17.5 percent of rural population) and is reported in the census only as non-farm.

Consistent with the national trend, Ohio's non-metropolitan population has grown at a faster rate than its metropolitan population. Since the early 1970's the "rural turnaround" has resulted in 2 million more Americans moving to rural areas than have left. This contrasts sharply with the net exodus of 5 million rural residents in the 1950's and the net loss of 2.2 million rural Americans in the 1960's. Figure 2 illustrates the percent population changes in Ohio by county between 1970 and 1980. Figure 3 illustrates those counties that experienced a population turnaround (either positive or negative) from 1970 to 1980. The most important finding is that from 1970 to 1980 growth has taken place in Ohio's Appalachian rural counties which experienced a population loss in 1960-1970.

Ohio ranks second to Texas in the number of Standard Metropolitan Statistical Areas (SMSA's). Ohio's 17 geographically dispersed SMSA's provide part and full time job opportunities within commuting distance of many of the state's rural residents. Figure 4 documents the net commutation in Ohio by county in 1960 and 1970. Net commutation is expressed as a proportion of the total employed persons in county, by county. A negative sign implies net out-commutation, a positive sign, the reverse. Both high negative and positive values have important ser-

Figure 2

Percent Population Change
1970-1980
(Preliminary Count)

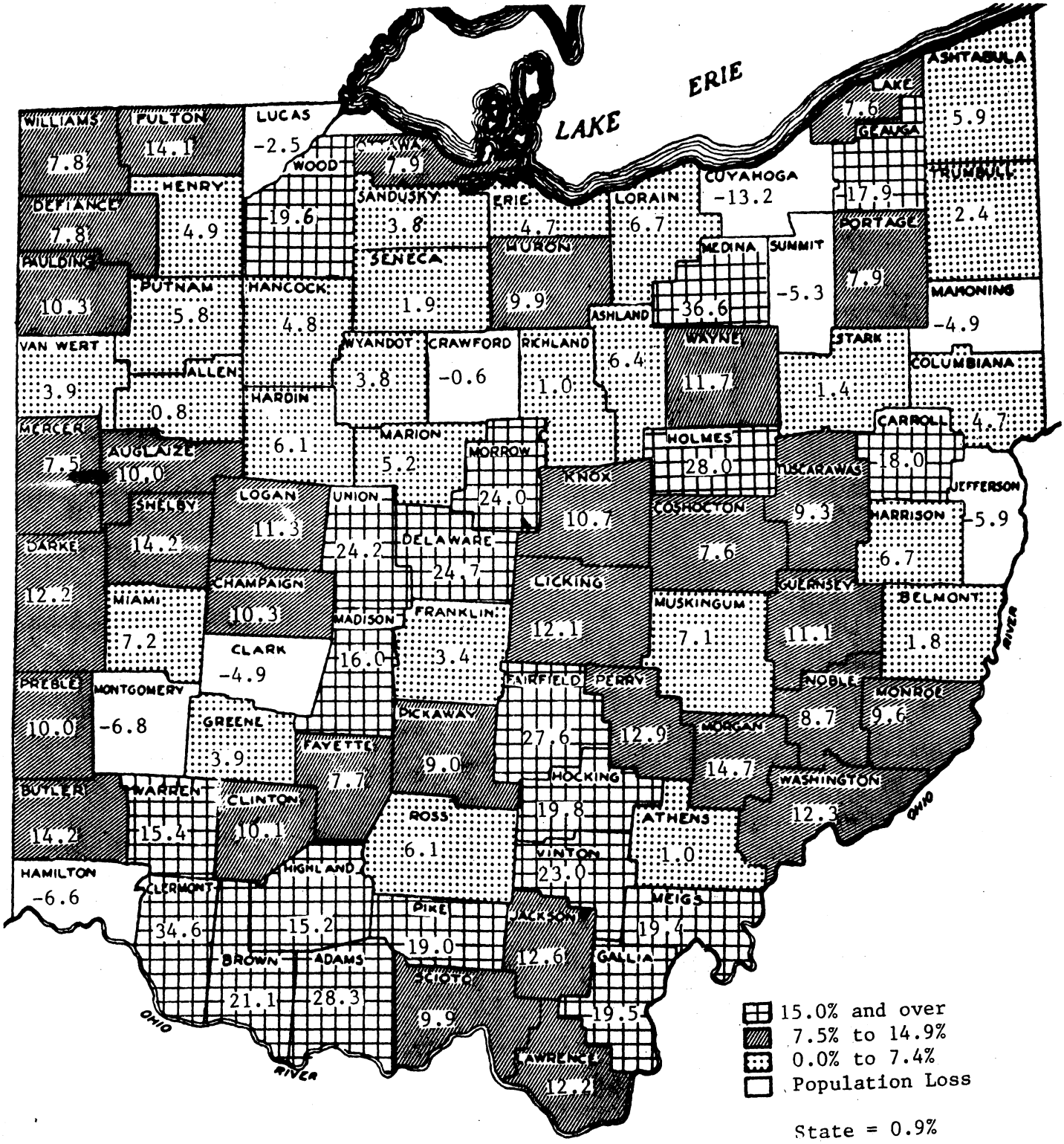
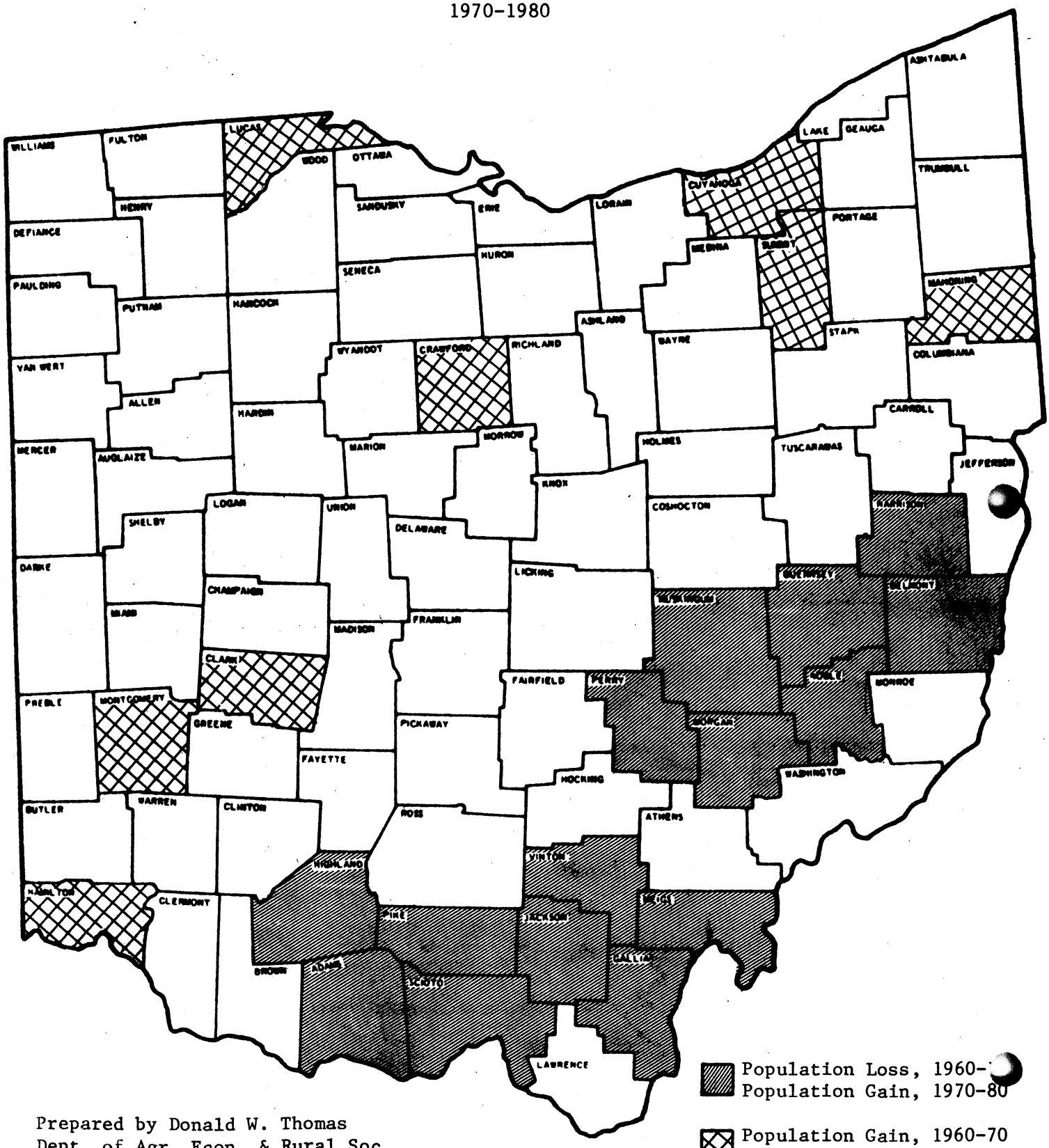


Figure 3

TURNAROUND COUNTIES

Population Change

1970-1980



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vice delivery and financing implications for both the donor and recipient communicates. In addition, a multiplicity of rural-urban fringe problems relating to displacement of prime agricultural land and other land use conflicts, annexations, and financing are associated with the relatively large number of SMSA's in Ohio.

Statistics from the U.S. Census Bureau, which showed that Ohio lost more population in 1976 than any other state, heightened the concern of policymakers about industrial employment shifts and loss of industry. Table 1 summarizes the changes in population and employment in the United States, Ohio and in the metropolitan and nonmetropolitan areas of Ohio from 1970 to 1976. During 1970-76 Ohio has shown less growth in population, total employment and manufacturing employment than has been the experience nationally. Within Ohio during this time period, metropolitan counties had a 0.7 percent decline in population, a 1.6 percent increase in total employment and a 10.5 percent decrease in manufacturing employment. The corresponding figures for nonmetropolitan counties in Ohio were increases of 4.1, 5.7 and 2.0 percent, respectively. However, the most rapid gains in population and employment from 1970 to 1976 were experienced in Ohio's 26 suburban metropolitan counties. Population in these counties grew 7.0 percent, total employment increased 10.0 percent and manufacturing employment increased 4.8 percent.

Table 2 provides a more detailed breakdown of covered employment (workers covered under the Ohio Unemployment Compensation Law) by

FIGURE 4

NET COMMUTATION IN OHIO AS A PROPORTION OF THE TOTAL EMPLOYED PERSONS IN COUNTY BY COUNTY, 1960 AND 1970 [1970 (1960)]

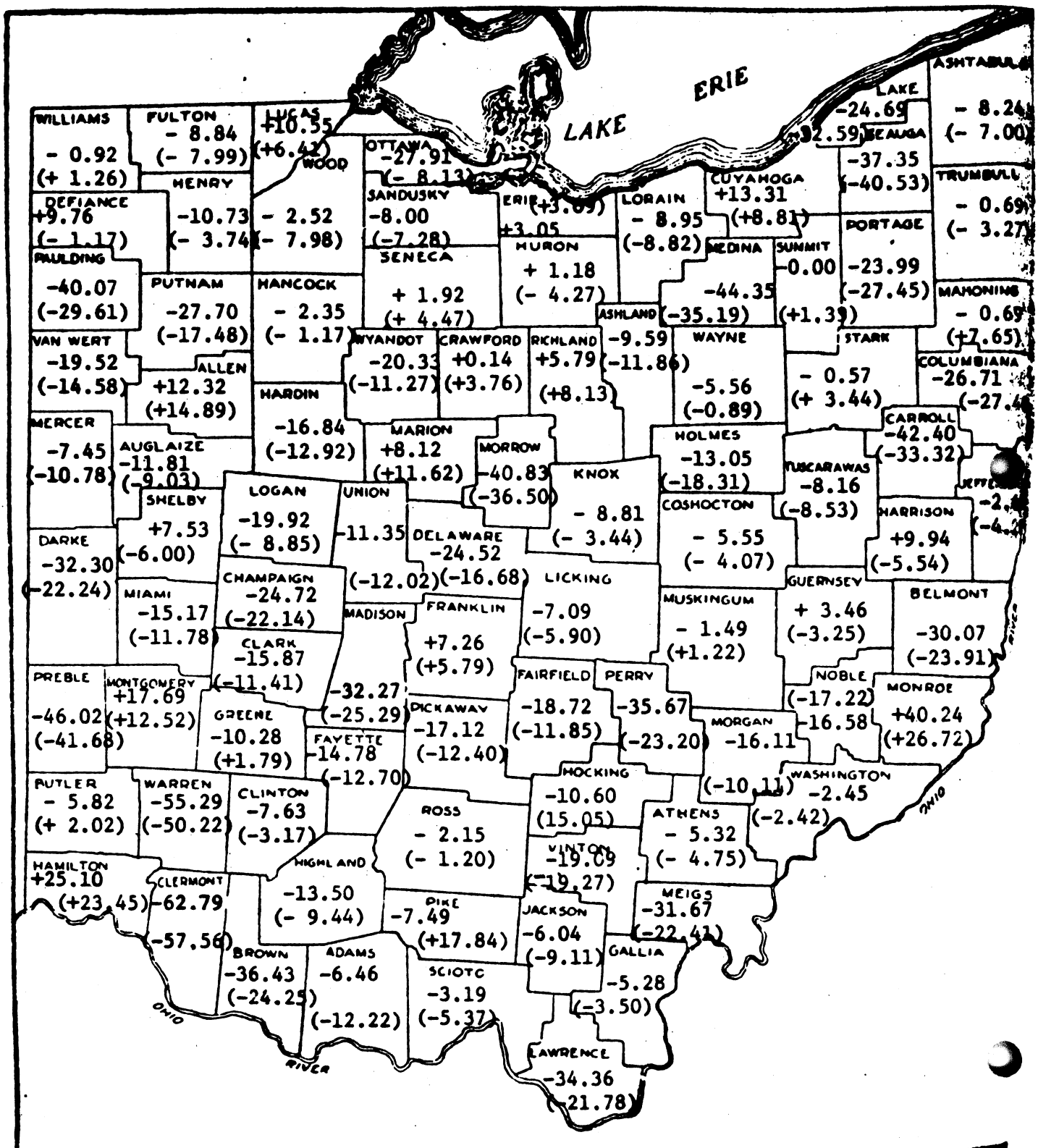


Table 1

Changes in Population and Employment, United States, Ohio, and Metropolitan and Nonmetropolitan Areas of Ohio, 1970-1976

Area	Percent Change, 1976 from 1970		
	Population	Total Employment	Manufacturing Employment
United States	+5.3	+ 8.9	- 2.0
Ohio	+0.2	+ 2.4	- 8.4
39 Metropolitan Counties (17 SMSA's)	-0.7	+ 1.6	-10.5
13 Central City Counties	-3.0	- 0.1	-13.5
26 Suburban Metropolitan Counties	+7.0	+10.0	+ 4.8
49 Nonmetropolitan Counties	+4.1	+ 5.7	+ 2.0

SOURCE: Bulletin of Business Research, Statistical Supplement, Vol. LIII, No. 10, October, 1978. Center for Business and Economic Research, The Ohio State University, Columbus, Ohio.

Table 2

Covered Employment by Industry in Ohio, 1970 and 1979

Industry	Number 1973	Number 1979	Percent of Total 1973	Percent of Total 1979	Percent Change 1979/1973
Agriculture, Forestry & Fishing	9,450	18,506	0.3	4.5	+ 95.9[a]
Mining	23,150	31,557	0.7	0.8	+ 36.3
Contract Construction	167,654	182,905	4.8	4.4	+ 9.1
Manufacturing	1,424,000	1,379,000	40.7	33.4	- 3.2
Transport & Utilities	190,380	199,933	5.4	4.8	+ 5.0
Wholesale and Retail	852,782	975,995	24.3	23.6	+ 14.4
Finance, Insurance, Real Estate	168,062	193,889	4.8	4.7	+ 15.4
Services	552,533	724,421	15.8	17.5	+ 31.1
State and Local Government	115,184	521,223	3.3	12.6	+352
TOTAL	3,502,979	4,130,914	100.	100.	+ 18

SOURCE: Ohio Bureau of Employment Services, Ohio Labor Market Information, 1973 and 1979.

[a]Nurseries and landscape firms account for increase.

industry in Ohio for 1973 and 1979. Uncovered workers may not be proportionately distributed over industry types. Thus, these data may over or understate the relative importance of some industries. Given this limitation, it appears that agriculture, forestry and fishing; mining; services, and state and local government all gained in terms of percent of total employment from 1973 to 1979. All other industry categories lost in terms of percent of total employment during the same time period. Manufacturing was the only category to show an absolute decline in employment in Ohio from 1973 to 1979.

State and local government employment in Ohio showed the largest percentage increase from 1973 to 1979 followed by agriculture, forestry and fishing; mining, and services. The growth of state and local government in Ohio appears consistent with a national trend. Inspite of the current political rhetoric concerning the growing size of the Federal government, state and local governments have grown more rapidly. From 1953 to 1977 state and local government expenditures in the United States increased from 7.4 to 14.1 percent of GNP. During the same time period, Federal government expenditures as a percent of GNP increased slightly from 21.2 to 22.4 percent.

Considerable research has been done in AERS to determine the private and public costs and benefits of developing industrial parks, tax and various other incentives, and locating various types of industries in nonmetropolitan areas of Ohio (11,25). Most of this research has been incorporated into a computerized growth impact model which is now operational for extension programming with individual communities concerned about their future economic development options (24).

Rural governments/services

Ohio has more than 3200 units of local government including 88 counties, 229 cities, 707 villages, 1324 townships, 625 school districts and 228 special districts. Although Ohio nonmetropolitan areas have approximately 25 percent of total state population, approximately 75 percent of Ohio's units of local government are in nonmetropolitan areas. These nonmetropolitan local governments or communities have annual revenues and expenditures exceeding $2.5 billion. They also have many problems relative to the delivery and financing of a wide array of community services and facilities.

A total of 47 local government officials in six nonmetropolitan counties of Ohio were interviewed as part of reputational surveys conducted in 1971-73. Their rank of important community problems was as follows:

Problem	No. of Responses
Industry/job creation	20
Water and air pollution	18
Planning, zoning, land use	17
Schools (consolidation,vocational)	14
Roads and bridges	14
Sewage treatment	13
Water supply	12
Tax structure and level	11
Law enforcement (vandalism, drugs)	9
Housing	8
Solid waste (land fills, littering)	8

This type of information influenced the development of conceptual information on the classification of local government services such as that summarized in Table 3. It also resulted in specific AERS research projects on the economics of rural solid waste management, water supply, land application of sludge, ambulance service, and a recent project on bridge rehabilitation (28,6,27,23,17). Research on Federal revenue sharing found evidence of formula bias against smaller governments (Table 4). The bias results primarily from the omission of volunteer efforts and user charge financed services from formula measures of fiscal effort (14).

Land Use Overview

Population growth and the decentralization of people and commercial activity from central urban centers into the urban-rural fringe and rural areas has caused significant changes and problems in land use in Ohio. Strong private market incentives and relatively ineffective non-market land use controls have resulted in strip residential and commercial development, urban sprawl, mini-farms, leap-frog subdivision developments, increased strip and deep shaft mining activity, and various forms of point and nonpoint pollution.

Ohio, with 26.2 million acres, ranks 35th in physical land area among the 50 states. Approximately three-fourths of the state has been involved in several glacial invasions affecting both its soils and topography. In terms of land capability, 52.5 percent is in Class I or II, 23.9 percent in Class III, 7.6 percent in Class IV and 16.0 percent in Classes V through VIII. In 1967 Ohio's land area (Figure 5) included 49 percent cropland, 24 percent woodland or forestland, 11 percent urban and built-up, 11 percent pastureland and 5 percent other. The comparable figures for 1977 were 45 percent cropland, 23 percent woodland,

Table 3. LOCAL GOVERNMENT SERVICE CLASSIFICATION MATRIX

Direct Service Types	Cost Per Capita ($)[a] Ohio	Cost Per Capita ($)[a] U.S.	Service Policy Criteria: Measure Output Easily	Growth vs. Maint.	Major Size Economies[b]	Major Spillovers Expected[b]	Income Redist.[b]	Merit Good	Exclude Users Easily	Political Proximity Essential[b]	Other
Education	203.26	239.38	NO	G & M	NO	YES	YES	YES	YES	YES	
Public Welfare	17.90	43.63	NO	M	NO	NO	YES	NO	YES	YES	
Highways	30.01	30.87	YES	G	NO	YES	NO	?	?	YES & NO	
Hospitals	19.67	27.27	NO	M	YES	YES	YES	YES	YES	NO	
Police Protection	21.25	25.12	?	M	NO	NO	NO	NO	NO	YES	
Water Supply	15.50	18.40	YES	G	YES	NO	NO	?	YES	NO	
Sewerage	16.29	16.03	YES	G	YES	YES	NO	NO	YES	NO	
Housing and Urban Renewal	13.21	13.28	?	?	NO	YES	YES & NO	YES	YES	YES	
Fire Protection	11.90	12.69	?	M	NO	NO	NO	NO	NO	YES	
Parks and Recreation	8.11	11.40	NO	?	NO	NO	NO	YES	?	YES & NO	
Solid Waste	6.41	7.81	YES	M	NO	YES	NO	NO	YES	NO	
Public Health	6.20	7.23	NO	M	YES	YES	YES	YES	NO	NO	
Corrections	2.10	3.95	NO	M	YES	YES	NO	NO	YES	?	
Library	1.85	3.70	YES	M	NO	NO	NO	YES	YES	YES	
Natural Resources	1.02	3.21	NO	?	NO	NO	NO	YES	?		

[a]Expenditures per capita for county area, local governments 1971-72, U.S. Census of Government.

[b]Werner Z. Hirsch, "Local vs. Areawide Urban Government Services," National Tax Journal, Vol. XVII, No. 4, December 1964, pp. 333 and 336.

Table 4

FEDERAL REVENUE SHARING PAYMENTS TO
OHIO LOCAL GOVERNMENTS, 1972-76

Unit of Government	Population[a] 1973	FRS Payments 1972 thru June 1976 Total ($ mil)	FRS Payments 1972 thru June 1976 Per Capita ($)	FRS Payments Fiscal Year 1976 Total ($ mil)	FRS Payments Fiscal Year 1976 Per Capita ($)
County	10,743,371	171.6	15.97	55.6	5.18
Township	3,251,954	52.6	16.17	16.6	5.10
City	6,613,398	298.4	45.12	94.6	14.31
Village	878,019	19.6	22.32	6.3	7.18
Totals	X	542.2	X	173.1	X

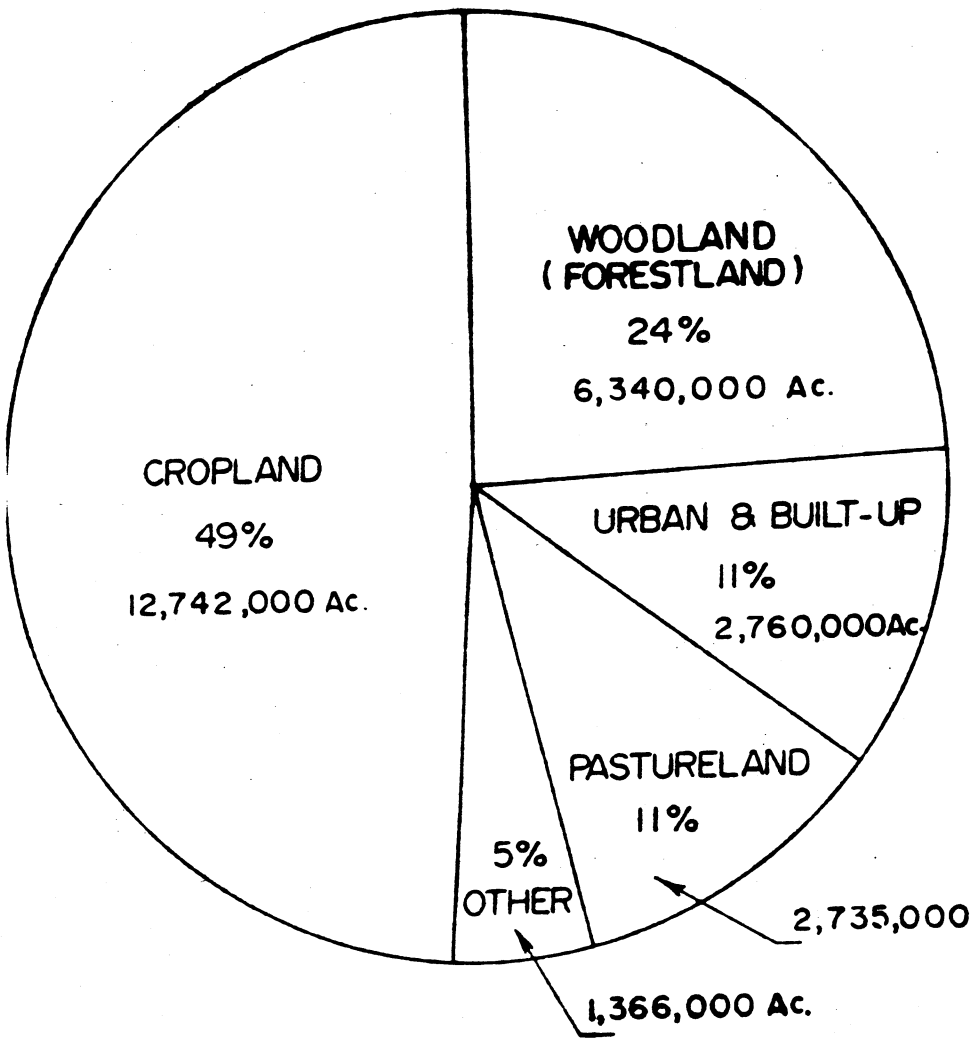
Sources: 1. U.S. Bureau of the Census, "1973 Population and 1972 Per Capita Income Estimates for Counties, Incorporated Places and Selected Minor Civil Divisions in Ohio," Series P-25, No. 580, May 1975.

2. Ohio Public Expenditure Council, "Federal General Revenue Sharing Allocations to Ohio, 1972-76", Tax Facts, 76-11, p. 2.

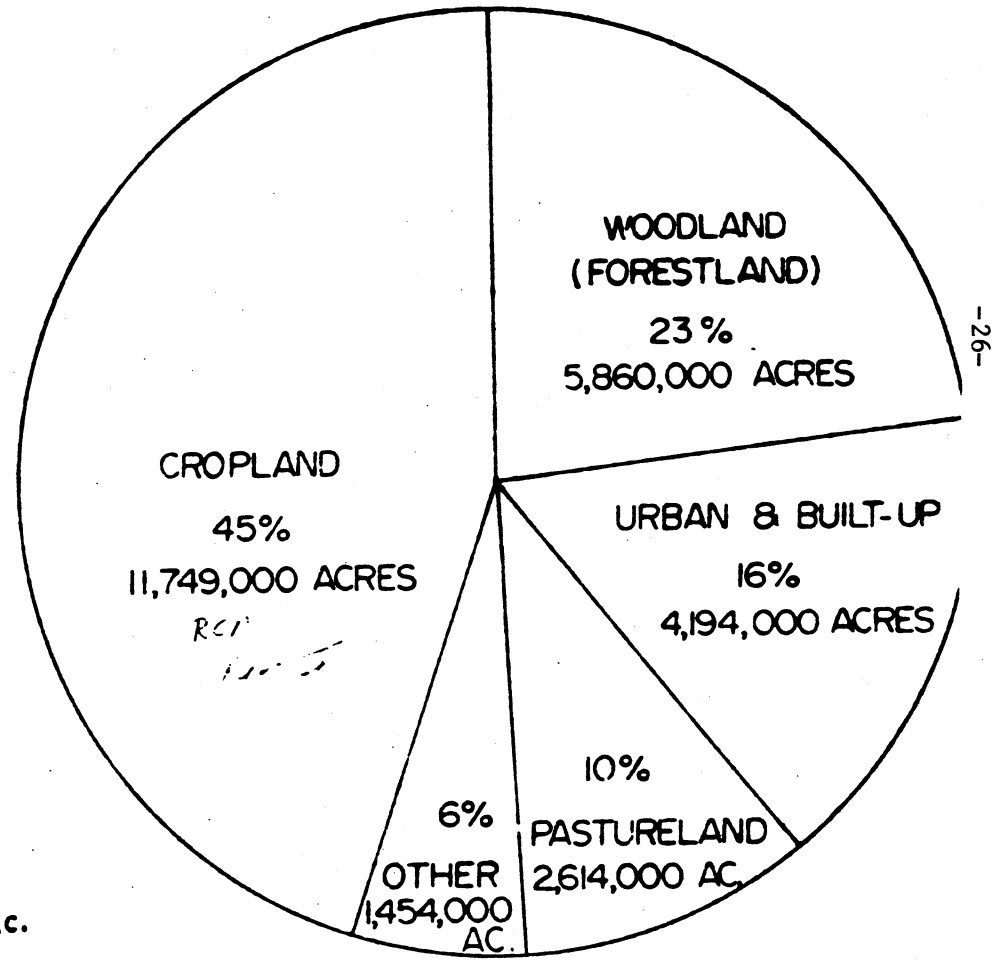
[a]Based on estimates for 1973. The sum of individual county population estimates is equal to the state population estimates. Township population is defined as the difference between individual county population and the sum of the city and village population estimates within each county.

Figure 5

LAND USE IN OHIO 1967



LAND USE IN OHIO 1977



1/ 1967 DATA FROM OHIO CONSERVATION NEEDS INVENTORY; 1977 DATA FROM OHIO NRI

16 percent urban and built-up, 10 percent pastureland and 6 percent other. The largest percentage increase from 1967 to 1977 is associated with urban and built-up land uses. Some understanding of this land market resulted from AERS research utilizing a reduced form demand model (19).

Woodland or forestland acreage declined slightly from 1967 to 1977. However, as Table 5 shows, ownership of forestland changed during approximately the same time period (1968-79). Forestland in private ownership increased from 51.0 to 61.6 percent and public forestland ownership increased from 5.5 to 6.4 percent. However, on farm forest ownership declined as a percent of total from 1968 to 1979. These ownership shifts may have implications for implementation of future forest biomass for energy projects.

Biomass for Energy

The biological potential of forest biomass for energy in Ohio has been assessed in a preliminary study recently completed by Battelle. The results of that assessment (Table 6) show a total annual potential (including harvest and sawmill residual and unharvested annual growth) of 31.3×10^{12} BTU's of energy for Ohio. A recently completed AERS MS thesis looked at sustainable yields and economic feasibility of combustion and gasification of wood chips for energy in a five county S.E. Ohio area. The results look very promising, particularly for gasification of wood chips to substitute for natural gas and fuel oil in boilers (5).[7]

Increased interest in also developing for various forms of crop biomass for energy in Ohio. One AERS research project has assessed the economic feasibility of corn stover as a supplementary fuel with high

Table 5. Forestland in Ohio

Forestland Ownership	1968[1]		1979[3]		Percent Change 1979/1968
	Million Acres	Percent Forestland	Million Acres	Percent Forestland	
Commercial	6.33	100.0	6.22	100.0	- 1.74
On Farms	2.69	42.5	1.99[2]	32.0	- 26.02
Private Forest	3.29	52.0	3.83	61.6	+ 16.41
Public Forest	0.35	5.5	0.40	6.4	+ 14.29

[1]U.S.D.A. Forest Service, The Timber Resources of Ohio, N.E. Forest Experiment Station, F.S. Resource Bulletin, N.E.-19, 1970, Table 2, p. 60.

[2]U.S. Department of Commerce, 1979 Census of Agriculture, Preliminary Report Ohio, July 1980.

[3]U.S.D.A. Forest Service, preliminary data from The Timber Resources of Ohio 1980, forthcoming publication.

Table 6. **SUMMARY OF UNUSED WASTE WOOD QUANTITIES IN OHIO BY REGION-1978**

Waste Wood Type	U.S.D.A. Forest Service Regions										Totals[a]	
	South Central		South Eastern		East Central		North Eastern		Western			
	$10^6 ft^3$	10^{12} Btu	$10^6 ft^3$	10^{12} Btu	$10^6 ft^3$	10^{12} Btu	$10^6 ft^3$	10^{12} Btu	$10^6 ft^3$	10^{12} Btu	$10^6 ft^3$	10^{12} Btu
Harvest Residues	11.94	3.02	9.56	2.42	9.96	2.52	4.53	1.15	7.48	1.89	43.47	11.0
Sawmill Residues	2.74	0.69	2.72	0.69	0.36	0.09	0.34	0.09	0.34	0.09	6.49	1.6
Subtotals	14.68	3.71	12.28	3.11	10.32	2.61	4.87	1.23	7.82	1.98	49.96	12.6
Residues from unharvested annual growth	8.84	2.24	7.07	1.79	7.37	1.86	3.35	0.85	5.54	1.40	32.17	8.1
Subtotals[b]	23.52	5.95	19.35	4.90	17.69	4.48	8.22	2.08	13.36	3.38	82.13	20.8
Entire volume of unharvested annual growth	20.05	5.07	16.05	4.06	16.73	4.23	7.61	1.93	12.56	3.18	73.00	18.5
Totals[c]	34.73	8.79	28.33	7.17	27.05	6.84	12.48	3.16	20.38	5.16	123.00	31.1

(a) Totals do not necessarily check due to independent rounding.
(b) Includes total of harvest residues, plus sawmill residues, plus residues from unharvested annual growth.
(c) Includes total of harvest residues, plus sawmill residues, plus the entire volume of unharvested annual growth.

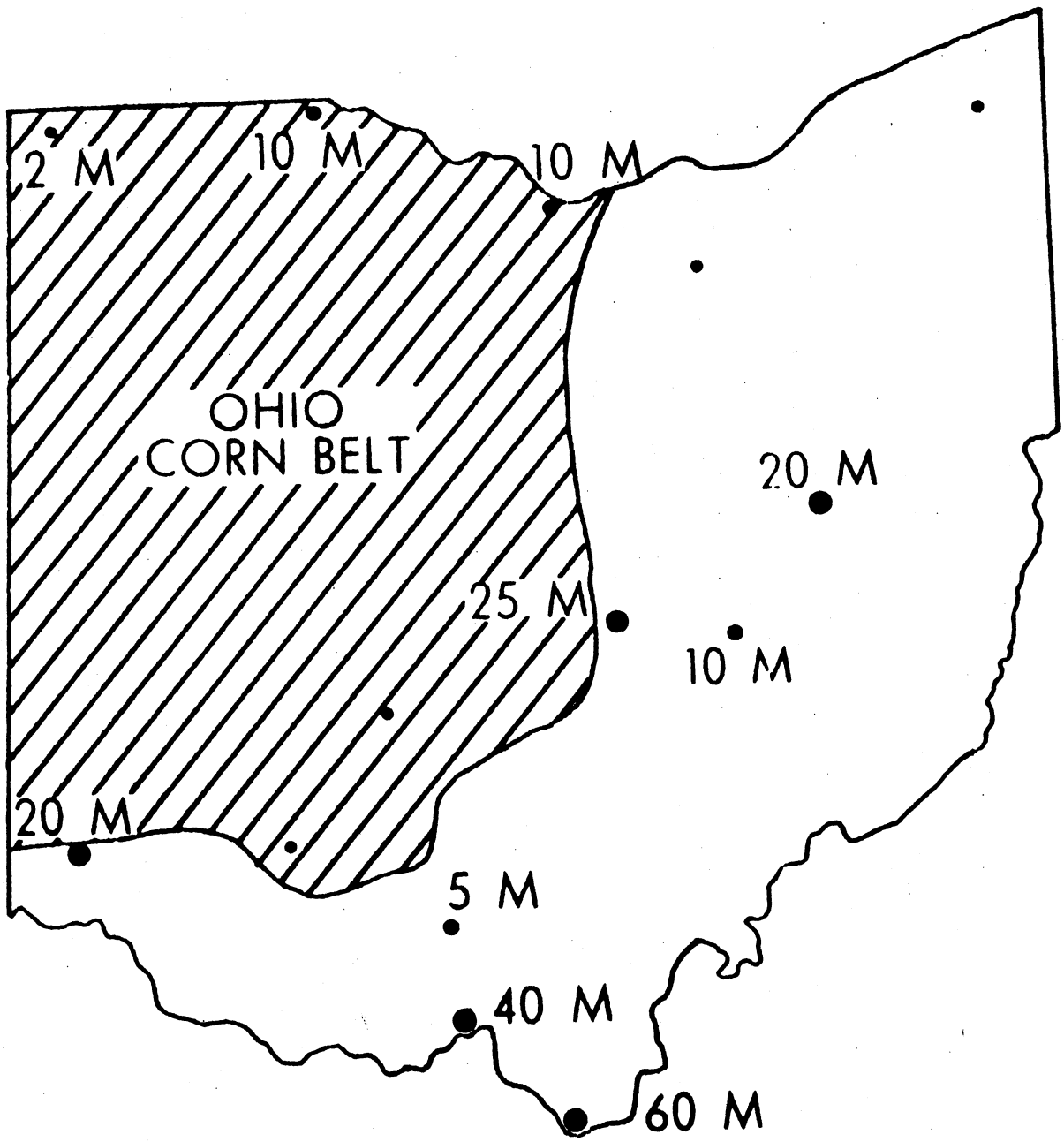
sulfur coal in steam-electric boilers with promising results (15). Research has also been completed on the economics of alcohol distillation from corn grain in Northwest Ohio (27). The model for this research was previously developed for analysis of alcohol production in Brazil. If the planned ethanol plants (Figure 6) in Ohio all come to fruition, the combined feedstock demand could equal 20 percent of the corn crop in Ohio. A corn alcohol program of this magnitude has important implications regarding livestock feed prices, corn substitution for other crops, potential soil losses, etc.

The current AERS research on crop and forest biomass for energy as well as earlier work on resource recovery from solid waste (16) is concerned with finding economically feasible renewable sources of energy. Ohio has relatively abundant reserves of coal, but they are high in sulfur and currently make up less than half of energy consumption in the State (Table 7). Because of the high sulfur content, Ohio also imports about 40 percent of the coal consumed within the State. The possibility of mixing various forms of biomass with Ohio high sulfur coal thus appears to be an important issue along with coal gasification. Petroleum increased as a percent of Ohio energy consumption from 27.4 percent in 1973 to 32.9 percent in 1979.

Mining of Coal and Soil

Any increased production of coal from surface mines in Ohio will further increase the importance of strip mine reclamation as an issue. Ohio currently ranks second in the U.S. in total land area disturbed (340,389 acres) by all forms of surface mining and fourth in land area disturbed (3,894 acres) by surface coal mine production. Some AERS

Figure 6



Planned Corn Ethanol Plants - Jan. 1981
(million gallons per year)

Table 7 Ohio Energy Production and Consumption 1972 and 1979

Energy Source[1/]	Consumption 10^{12}BTUs 1972	1979	Percent of Total 1979	Production 10^{12} BTUs 1979	Production as % of Consumption 1979
Natural Gas	1200	975.7	24.2	127.3	13.05
Petroleum	1050	1322.9	32.9	69.3	5.23
Coal	1590	1697.3	42.2	1055.3	62.18
Nuclear and Hydro	NA	29.76	.7	NA	NA
Total	3840	4025.7	100.0	1251.9	31.09

Electricity generated = 92% by coal,
5% by petroleum and
3% by nuclear and hydro plants
for a total of 428 x 10^{12} BTUs in 1979.

Source: Ohio Department of Energy, Energy Status Report, 1979.

research on the economics of coal strip mine reclamation has been completed (8). Reclamation is costly (average of $4800/acre) and there will be increased debate between coal/job and environmental interests on an optimal reclamation strategy.

Table 8 summarizes the status of conservation treatment to agricultural and forest land in Ohio. With the exception of the pastureland category, it appears that some progress was made from 1967 to 1977. The principal hazards of Ohio cropland are outlined in Table 9. Wetness appears to be the most common problem followed by soil erosion which affects 4,467,180 acres. The 1977 USDA National Resource Inventory shows Ohio with an estimated average annual sheet and rill erosion on cropland of 3.6 tons/acre/year. A total of 1,574,000 acres of Ohio cropland are estimated to have annual sheet and rill erosion in excess of 5 tons/acre/year.

Some AERS research on non point pollution and the economics of alternative tillage systems has been completed. It appears that soil moving minimum tillage practices are cost-effective on about 75 percent of Ohio's cropland. Additional work is progressing on the downstream costs of harbor and ditch dredging and municipal water treatment as well as long run productivity impacts. Soil loss issues may increase in importance if biomass for energy places additional stress on the environment.

Lake Erie Fishery

Ohio borders Lake Erie which has historically supported a commercial and sport fishing industry, transportation facilities for several state imports and exports by oceangoing vessels,[8] salt, sand and gravel mining and water supply. Sublake deposits of oil and gas are currently

Table 8

Status of Conservation Treatment to
Ohio Agricultural and Forest Land

Use	Adequate Conservation		Need Treatment	
	1967	1977	1967	1977
Cropland	4,500	3,743	8,241	8,006
Pastureland	897	575	1,839	2,029
Forest & Woods	970	727	5,370	5,143
Total	6,367	5,045	15,450	15,188

Source: Ohio Resources Inventory, Soil Conservation Service, USDA, undated.

Table 9 PRINCIPAL HAZARDS ON OHIO CROPLAND

Hazard	Acres	Percent
Little or None	548,058	4.3
Erosion	4,467,180	35.1
Wetness	7,500,037	58.8
Soil Limitations	226,598	1.8
Total	12,741,873	100.0

Source: Ohio Soil and Water Conservation Needs Inventory, 1971

under an anti-production moratorium. Lake Erie has also been the focus of a long standing environmental debate over pollution of the lake's water by industrial, municipal and nonpoint sources. A revived commercial and sport fishing industry and beaches once again safe for swimming suggest that progress has been made in the effort to "clean up" Lake Erie.

The shallowness of Lake Erie makes it potentially the best freshwater fishery in the world. Maumee and Sandusky Bays offer 90 square miles of sheltered waters ideal for fish spawning and habitat. The Lake Erie fishery is currently second only to the New England cod fishery in terms of fish population.

The revival of Lake Erie has increased the potential conflict among its many users. With support from the Sea Grant program, AERS is currently involved in a study on the economic impact of the Lake Erie fishery including sport, commercial and charter fishing and bait dealers. The study is also examining the interrelationship of fishing with non-fishing uses of the lake. Input/output analysis, a growth impact model and proxy demand functions for sport fishing are the primary methodological constructs.

Emerging Forces/Research Issues

Specific Ohio Client/User Issues

One source of information on emerging issues relevant to resource economics research is those individuals or groups perceived as client/users of the research. A total of 31 client/users were identified in Ohio as representative (see Appendix C) and were contacted with a letter and mail survey. A total of 18 responses had been received at the due date of this draft paper and those responses are summarized in Table 10. There is some evidence of a higher non-response in the rural community vs. natural resource economics area.

Table 10: Rank of Major Trends, Issues, Forces Relevant to Resource Economics Research
n = 18

Trends, Issues, Forces	No. Responses
Displacement of prime agricultural land	7
Government service cuts	5
Biomass for energy	4
Rising energy and living costs	4
Economy impact on decisions	3
Increased soil loss/erosion	3
Economic cost of environment improvement	3
Economic development	3
Loss of wildlife and fish habitat	2
Loss of woodland and forest acres	2
Land and water pollution	2
Energy conservation	2

Displacement of prime agricultural land ranked first followed by concern over government service cuts and biomass for energy. One respondent expressed the concern that "we might be eating our seed corn" with the current and proposed government service cuts. Specific biomass for energy alternatives mentioned included methane, gasohol and crop and forest residue. The issues of rising energy and living costs and impact of the economy on private and public decisions may be alternative ways of saying the same thing. The issue of soil loss and the equally important concern (three responses each) over the economic costs of environmental improvement may be somewhat off-setting. Concerns under the issue of economic development included increased industrial base, rural non-farm jobs and new small business opportunities.

Table 11 summarizes the findings of a recent survey of County Rural Development Committees in Ohio regarding key problems or issues. Soil and erosion control ranked first followed by land use, water and sewer, forestry, local health, local housing and rural unemployment. These issues or problems were pre-identified by the Ohio ASCS Office conducting the survey and respondents were asked to rank them along with any "other" concerns.

Toward a Synthesis

A number of general emerging issues or future research possibilities in resource economics can be synthesized from the previous sections of this paper, from client/user perceptions and from several discussions among AERS resource economics faculty members. Increasing evidence of various forms of environmental stress and declining stocks of fossil fuels are of concern to both developed and developing countries. The

Table 11: Ranking of Key Problems/Issues by Ohio County R.D. Committees

Rank	Area
1.86	Soil and erosion
2.15	Land use
4.07	Water and sewer
4.66	Forestry problems
5.52	Local health
5.73	Local housing
5.77	Rural unemployment

Source: Survey done by State ASCS in December, 1980.

economics of mining reclamation, reforestation, soil loss, energy conservation and various renewable energy alternatives would appear to be research thrusts consistent with these natural resource concerns.

There are a number of major changes underway in the character of work including increased use of computers and robotics, shifts in jobs from the factory to the home and relatively less emphasis on goods. These trends combined with the rural population turnaround suggests some rethinking of conventional rural economic development strategies. Of particular concern is the preoccupation with attracting branch manufacturing plants and jobs to rural areas.

The current political rhetoric on reducing the Federal government and allocating more functions to state and local governments seems to be a lagged recognition of what has already happened in part. From 1953 - 77 state and local government expenditures increased relative to Federal government expenditures. There is some evidence of a decentralization of government mood including more block grants. This may have implications for nonmetropolitan governments as well as regional or multi-state governments such as the Ohio River Valley region.

The tax/expenditure limitation movement is more difficult to assess. On the surface it appears to reflect a general concern for reducing the size of government as a proportion and regulator of total economic activity in the United States. However, closer examination reveals that most people/interest groups still want fewer subsidies, tax breaks, import barriers, grants, etc. given to someone else rather than to themselves. Inflation and its impact on economic well being

(or at least perceived well being) may be a major factor in this case. It would seem that user charge financed government might grow in relatively importance in this environment even if tax financed government declines.

The increased recognition of an interdependent world is particularly evident in the case of environmental resources and international markets for fossil fuels, other critical minerals, food, automobiles, etc. Goods, money, ideas, people and problems are crossing national boundaries as never before in history. Inflation and supply shocks of energy and food are felt around the world. Third world countries are growing in importance due to their ability to form cartels on oil and other critical resources and to the increasing interest of international lending groups and super powers in the third world.

As a minimum, it would seem prudent to identify potential areas of complementarity between some of the foregoing international issues and emerging resource economics issues in Ohio. Some of this complementarity is already evident in the "economics of gasohol" research in Brazil which led to subsequent work in Ohio. In addition, Title XII financed improved methodology for project analysis has led to a computerized model for financial, economic and income distribution analysis of projects. Other areas for consideration might include soil loss, forest biomass for energy and non-farm employment opportunities.

Footnotes

* Associate Professor, Resource Economics, Department of Agricultural Economics and Rural Sociology, The Ohio State University. An overview paper prepared for a department research review by Cooperative Research, USDA, April 21-24, 1981.

1. A significant increase in foreign student enrollment in the department resource economics field (currently 13 out of 21 graduate students) provides additional evidence of complementarity.

2. The first part of this section draws heavily from Salter's excellent review of research in land economics (30).

3. Castle identified physical interdependence (of production and/or utility functions) as the main reason for importance of externalities in the economics of land. When indivisibilities exist, the marginal social cost of usage will be zero over a wide range and any toll or price will tend to misallocate output of the "lumpy" resource.

4. One source estimates that dessertification from deforestation is claiming an area the size of the State of Massachusetts each year.

5. The following are representative of the findings. Most of the rural poor do not live on farms. Hunger, disease and premature death are common among the rural poor. Unemployment and underemployment, poor schools, substandard housing and impoverished communities are also major problems in rural America (33).

6. A report, A New Life for the Country made during the Nixon Administration was primarily an updated version of the earlier People Left Behind report.

7. Comparable studies are under consideration in the Dominican Republic and Ghana.

8. A total of 90 million tons of cargo annually with grain, coal, iron ore and paper as the main products

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APPENDIX A

RESOURCE ECONOMICS PROGRAM
Department of Agricultural Economics and Rural Sociology

Outline of Research Priorities

I. Land and Water Use

A. Biomass for Energy

1. Crop and forest residue combustion
2. Alcohol fuels from grain and wood
3. Methane from waste and residues

B. Conservation - pollution

1. Control of point and non-point source pollution
2. Land application of sludge
3. Strip mine reclamation
4. Resource recovery from solid waste

C. Spatial Allocation

1. Land market behavior
2. Property rights structures in land and water
3. Impacts of alternative control tools

II. Community and Regional Industrialization

A. Economic impact of alternative industrial activities (branch manufacturing plants, indigenous industry, large resource extraction - energy projects, Lake Erie fishing industry, etc.)

B. Economic impact analysis of local growth policies (tax abatements, industrial parks, promotional campaigns, annexation)

C. Economics of labor force behavior and skill development

D. Economic impacts of population reversal

III. Community Services

A. Delivery

1. Analysis of cost and quality of selected community services as affected by scale and other factors (solid waste, emergency ambulance, water, sewer, industrial parks, fire protection, rural roads and bridges)

B. Finance

1. Local sources (property and income taxes, user charges, contracts, volunteerism)
2. Federal and State revenues (federal revenue sharing, tied grants)

APPENDIX B

BIOMASS FOR ENERGY PUBLICATIONS

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The Ohio State University

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APPENDIX B
(cont.)

LAND AND WATER ECONOMICS PUBLICATIONS

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The Ohio State University
and
Ohio Agricultural Research and Development Center

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APPENDIX B
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